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Human Factors in Mining Search System

By Richard S. Fowkes and Elaine G. Aiken

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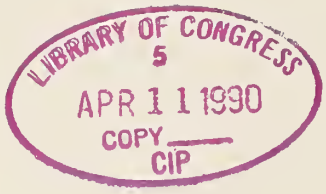
UNITED STATES DEPARTMENT OF THE INTERIOR
Manuel Lujan, Jr., Secretary

BUREAU OF MINES
T S Ary, Director



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CONTENTS

ILLUSTRATIONS

TABLES

HUMAN FACTORS IN MINING SEARCH SYSTEM

By Richard S. Fowkes[1] and Elaine G. Aiken[2]

ABSTRACT

This Bureau of Mines report describes the Human Factors in Mining Search System (HFMSS), a computerized information retrieval system that provides relevant human factors information from journal articles, research reports, seminars, conferences, etc. in terms of 19 mining-related categories. It is the only existing data base that stresses all of the areas of human factors as applied to mining. Examples of these categories are biomechanics and work physiology, human error and human reliability, work design and task analysis, manual materials handling and back injuries, hand tools, organizational and management practices, psychological factors, and training. Although the emphasis is on literature dealing directly with mining, applicable material from other areas of research is included for those categories in which little research has been done in mining. Each record in HFMSS can be recalled by any field such as title, author, date, source, descriptive terms or key words, as well as by any words found in an abstract that describes the purpose, procedure, and results of the research. This report describes HFMSS fields and subject categories, the annotated bibliography, user's manual, and thesaurus of key words. Example printouts in both brief and full formats are included as an appendix.

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INTRODUCTION

"Human factors," the term most used in the United States and Canada (elsewhere this field is called ergonomics), can be most simply defined as designing for human use. A more detailed definition is the systematic application of relevant information about human characteristics, abilities, expectations, and behaviors to the design of machines, tools, facilities, procedures, and environments that people use. The goal of human factors is to enhance the operating efficiency and the health and safety of the people using the system.

As part of its mission to promote health and safety in mining, the Bureau of Mines has developed a computerized information retrieval system called the Human Factors in Mining Search System (HFMSS). The original title of the project was "Feasibility Study of a Mine Safety and Health Information System." The initial objectives were to identify user interest and information needs and to develop recommendations on the feasibility and priorities of information to be included in the system. On March 24, 1983, a joint committee of Bureau and Mine Safety and Health Administration (MSHA) personnel reviewed the project proposal and recommended that it be initiated. The joint committee also recommended certain modifications in the project proposal, which were made, and the project was retitled "Research To Establish a Mine Safety and Health Information System." The objective was "to research current industry needs for and implement an information retrieval system designed to provide effective *human factors* information and assistance to the mining industry. This is to be accomplished through a literature search, determination of industry needs, etc." This project was part of a larger project called "Reduction of Human Error Accidents in Underground Mining," a subject of great interest since numerous investigations have shown that most industrial accidents result from human error. Funding was allocated for the project, and work commenced in October 1983.

The initial task was to find out if there was any interest within the mining community in having a mine safety and health information system in general, and a human factors in mining information system in particular. Accordingly, 81 persons were contacted on this subject. They represented the following organizations or disciplines (the numbers in parentheses are the number of persons within the particular organization who discussed this matter): Bureau of Mines (8), MSHA (6), mining equipment design engineers (13), industrial firms that have or have had Government contracts (6), coal mine managers (4), coal mine safety engineers (10), metal and nonmetal mine safety engineers (8), information system specialists (14), universities (10), and associations (2). Both surface and underground mining experts were included. The most important overall conclusions based on these discussions were

1. There is a real need for a human factors mining information system since companies in general are not aware of the advantages to be gained in applying human factors to their mining operations and to equipment design and since no existing data base fulfills their requirement.

2. A major shortcoming in developing and implementing an overall safety and health information system is that the large majority of the functions such a system would include are already being covered. For instance, the Beckley Academy of MSHA has its Educational Materials Search System (EMSS), which focuses on training materials; the MSHA Health and Safety Analysis Center (HSAC) gathers and interprets mining accident statistics; the Bureau's research centers provide guidance and information to industry in the centers' research areas, and the Bureau's Pittsburgh Research Center has a Mining Research Management Information System (MRMIS), which lists approximately 6,000 Bureau publications.

3. The commercially available occupational health (and sometimes safety) information systems basically keep records on the health and accidents of employees, toxic chemicals, hazardous equipment, etc., and perform bookkeeping-type functions; they are usually large and expensive and are not applicable to the type of information system wanted for this project.

4. Safety engineers and managers at minesites are primarily interested in practical information and personal guidance that will help them in solving day-to-day problems.

5. Most mining people are rather vague in their understanding of what ergonomics or human factors is.

6. By having a human factors in mining information system available, Government and university personnel will be better able to inform mining company supervisory and safety engineers and equipment design engineers of ways to improve their safety and productivity through applications of human factors.

7. The greatest interest in a mining (not just safety and health) information system is from individuals involved in research or its applications, who work for the Government, at universities, with contractors, or on equipment design. Among the things they want to know is what is being done in and will be coming out of research and development projects. Even practical mining company people show an interest in finding out how they can use research results in solving or at least alleviating their problems. Some want to have access to references on literature dealing with an area or problem they are interested in.

8. A number of these contacts do not believe that the Government is disseminating information as effectively as it could on the results of its in-house and contract research and development. A frequent complaint is that the length of time is takes the Bureau to make the results of its research known to the mining industry is much too long.

9. As more mining personnel become computer knowledgeable and increasingly aware of the importance of human factors considerations in all areas of mining from equipment design to organizational and management practices, the greater the interest will be in a computerized

human factors in mining information system. In fact, such a system could potentially enhance the application of human factors to mine planning and problems and to research along human factors lines.

Thus, a human factors in mining computerized information system was feasible and was of particular interest at this time to the following:

- Bureau personnel doing in-house research and/or monitoring contract research.
- Bureau and MSHA personnel who provide information or assistance to the mining industry.
- Mining company employees, who can alleviate or solve problems amenable to the application of human factors methods.
- Equipment or hand tool designers, who can improve or significantly alter present designs by using human factors principles.
- Educators and trainers needing a source of information.

Once the desirability of a human factors in mining computerized information system had been determined, the next step was to find out what had been done in the design of information systems, what systems presently operating would satisfy the requirements for a human factors in mining data base, and where these systems were located. The basic criteria for the system were

- Ability to store and have viewed on a screen and/or in printed form records that would include title, author, source of the material, contract number (when appropriate), type of publication, date, descriptive terms or key words, an abstract, and other pertinent data.
- Ability to update or edit the records using the format above.
- Potential ability to be accessed through a dial-in terminal.
- Lowest possible cost as long as the system fulfilled the above requirements.
- Ease and quickness of installation.

The "Encyclopedia of Information Systems and Services"[3] alphabetically lists all of the information systems operating in the United States at the time of its publication and gives the name and address of each system, a description of it, the scope and/or subject matter, holdings and storage media, publications, clientele and availability, and contact persons. Several systems were applicable to the needs of the human factors in mining system.

Among these was the POISE Data Management System (DMS Plus),[4] which runs on a Digital Equipment Corp. (DEC) VAX series of computers using VAX/VMS as the operating system, and which met all of the criteria given above. It is a collection of about 25 generalized programs that enable the user to input, store, move, manipulate, and retrieve information in alphabetic or numeric form. The maximum number of characters (letters, numbers, symbols) for all of the fields for each record or entry is 2,047, exclusive of the names of the fields (title, author, date, etc.). The minimum number of characters that can be used for an entry is 31. The POISE system was being installed at the Bureau's Pittsburgh Research Center and was also being used by the MSHA's National Mine Health and Safety Academy, the West Virginia Department of Mines, and the West Virginia University's Mining Extension Service. Hence, POISE was readily available, and HFMSS could eventually become part of a system incorporating several other data bases without running into problems of software incompatibility.

CATEGORIES

As Bureau publications, magazine articles, papers from seminars and conferences, etc. were gathered, it became apparent that in terms of the Bureau's human factors research program, these publications fell into rather well-defined topic categories. Some covered more than one category, but this was taken into consideration by listing more than one category in the descriptive terms field and assigning the record or entry to the category that seemed most important with respect to the entry. Some dealt with human factors in a general way, so a category to include these was titled "human factors". This utilization of categories would enable users of HFMSS to understand more quickly and easily what subjects were encompassed by the data base and to determine more readily what they wanted to retrieve from the system. This subdivision of HFMSS into categories would also be an aid in literature searches, including accessing computerized data bases, and would make it easier to talk with experts to ensure that all of the significant material relevant to mining had been entered under a particular category. The 19 categories decided upon and their accession number ranges (an accession number is the number assigned to a record when it is entered into the computer) are shown in table 1.

For each entry in HFMSS, the category to which it is assigned comes first in the descriptive terms field. This highlights what the particular reference emphasizes.

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[3]Gale Research Co., 1981, 933 pp.

[4]Reference to specific products does not imply endorsement by the Bureau of Mines.

Table 1.–Categories and accession number ranges for HFMSS

Accession number range	*Category name*
1-500	Anthropometrics, biomechanics, and work physiology.
501-1000	Cost-benefit analysis.
1001-1500	Equipment: auditory devices, canopies, controls, operator compartments, visual displays.
1501-2000	Female miners and female workers.
2001-2500	Hand tools.
2501-3000	Human error and human reliability.
3001-3500	Human factors: applications, methods, principles, studies.
3501-4000	Illumination.
4001-4500	Job or work design, and task analysis.
4501-5000	Manual materials handling, and back injuries.
5501-6000	Noise: control, effects, measurement, standards.
6001-6500	Organizational and management practices.
6501-7000	Personal protective equipment and clothing.
7001-7500	Psychological factors: absenteeism, behavior modification, incentive plans, job satisfaction, motivation, stress, turnover.
7501-8000	Safety assessment methods.
8001-8500	Thermal stress.
8501-9000	Training: cost effectiveness, methods, principles, results, studies.
9001-9500	Vibration: machinery, tool, limbs, whole body.
9501-10000	Visibility.

FIELDS

An entry or record in HFMSS consists of 58 fields. A field is defined as some specified number of adjacent character positions (digit, alphabetic letter, or special symbol), which can contain a single data element or item of information. In a POISE data file, a field is a specified location in a record to store a single data element. Table 2 shows the pertinent information on the HFMSS fields.

An explanation of the column headings in table 2 is as follows:

1. The field number refers to the number used to identify the field in the POISE file, in this case an HFMSS record being the file. For instance, "Title line 1" is field 4 and "Title line 2" is field 5.

2. The field location gives the positions available for the characters that make up the fields within a single record. For instance, the field "Author(s)" is assigned character positions 158 through 227, although the name(s) may not require this much space.

Table 2.–HFMSS fields

Number	Location	Length in characters	Name	Code
1	1,5	5	Accession number	.AN
2	6,11	6	Entry date	.ENTRY_DATE
3	12,17	6	Review date	.REVIEW_DATE
4	18,87	70	Title line 1	.TITLE1
5	88,157	70	Title line 2	.TITLE2
6	158,227	70	Author(s)	.AUTHOR
7	228,231	4	Month and year published.	.PUB_DAT
8	232,234	3	Volume number	.VOL
9	235,236	2	Issue number	.NO
10	237,266	30	Source	.SOURCE
11	267,291	25	Contractor address	.CONT_ADD
12	292,300	9	Contract number	.CONT_NO
13	301,305	5	Bureau research center	.BU_RES_CTR
14	306,306	1	Contract final flag	.FINAL_FLAG
15	307,307	1	Contract phase flag	.PHASE_FLAG
16	308,308	1	RFP flag	.RFP_FLAG
17	309,309	1	Bureau series flag	.USBM_FLAG
18	310,310	1	Journal article flag	.JOURN_FLAG
19	311,311	1	Manual, guide flag	.MANUAL_FLAG
20	312,312	1	Rules, laws flag	.LAWS_FLAG
21	313,313	1	Seminars, training flag	.SEMI_FLAG
22	314,314	1	MSHA series flag	.MSHA_FLAG
23	315,315	1	Federal agency, not Bureau, MSHA.	.FED_FLAG
24	316,316	1	Foreign flag	.FOR_FLAG
25	317,317	1	Miscellaneous flag	.MISC_FLAG
26	318,328	11	NTIS number	.NTIS
27	329,333	5	OFR number	.OFR
28	334,337	4	Other number	.OTHER
29	338,342	5	Start page	.START_PAGE
30	343,347	4	Length	.LENGTH
31	348,422	75	Terms line 1	.TERMS1
32	423,497	75	Terms line 2	.TERMS2
33	498,567	70	Abstract line 1	.ABSTRACT1
34	568,637	70	Abstract line 2	.ABSTRACT2
35	638,707	70	Abstract line 3	.ABSTRACT3
36	708,777	70	Abstract line 4	.ABSTRACT4
37	778,847	70	Abstract line 5	.ABSTRACT5
38	848,917	70	Abstract line 6	.ABSTRACT6
39	918,987	70	Abstract line 7	.ABSTRACT7
40	988,1057	70	Abstract line 8	.ABSTRACT8
41	1058,1127	70	Abstract line 9	.ABSTRACT9
42	1128,1197	70	Abstract line 10	.ABSTRACT10
43	1198,1267	70	Abstract line 11	.ABSTRACT11
44	1268,1337	70	Abstract line 12	.ABSTRACT12
45	1338,1407	70	Abstract line 13	.ABSTRACT13
46	1408,1477	70	Abstract line 14	.ABSTRACT14
47	1478,1547	70	Abstract line 15	.ABSTRACT15
48	1548,1617	70	Abstract line 16	.ABSTRACT16
49	1618,1687	70	Abstract line 17	.ABSTRACT17
50	1688,1757	70	Abstract line 18	.ABSTRACT18
51	1758,1827	70	Abstract line 19	.ABSTRACT19
52	1828,1897	70	Abstract line 20	.ABSTRACT20
53	1898,1967	70	Abstract line 21	.ABSTRACT21
54	1968,2037	70	Abstract line 22	.ABSTRACT22
55	18,157	140	Full title	.TITLE
56	348,497	150	Full terms	.TERMS
57	498,1267	770	Half abstract 1	.ABSTRACT1
58	1268,2037	770	Half abstract 2	.ABSTRACT2

3. Field length in characters refers to the maximum number of characters the field can use. This is found by subtracting the smaller number under field location from the larger number and adding 1. The 1 is added since the field location starts with the lower number and includes the higher number. In the above example of "Author(s)," the maximum number of alphabetic letters, periods, apostrophes, spaces, etc. this field can use is (227 - 158) + 1 = 70.

4. The field name is what the particular field is called in HFMSS. The field names are discussed below.

5. The field code is what has been entered in POISE to represent the various field names. The field code can be used instead of the field number when performing a search. The period (.) must always precede the field code, since this is a requirement of POISE.

The field names have the following meanings:

1. Accession number.–The number given to the record by the person who enters the record into HFMSS. Each entry is first assigned to 1 of the 19 categories given in the previous section of this report and then given the next unused number within the accession range of that category. For example, if the last number that was used under the "Training" category was 8563, then the new entry would be assigned accession number 8564. There is no particular sequence within a category, accession numbers being solely dependent upon when the publication is recorded in HFMSS. In a few cases, a duplicate publication entry was deleted and the accession number reused for a later entry.

2. Entry date.–The month, day, and year the publication is entered into HFMSS. Numbers only are used, with a slash (/) between the month and day, and day and year. For example, 04/25/85 means April 25, 1985.

3. Review date.–An estimated time to look at the entry and decide whether it should be retained in HFMSS. The review date is exactly 1 year later than the entry date for the record. In the above example under 2, it would be 04/25/86.

4 and 5. Title line 1 and title line 2.–The title of the publication. Two lines (140 characters) are reserved for those cases in which the title is long.

6. Author(s).–The author(s) of the publication. Only one line (70 characters) is reserved for this field. In the few instances where there are several authors, "et al." is used after the first two or three names.

7. Month and year published.–The month and year in which the record was published. For books, in which only the year is given, and for a few other publications in which no month is given, no month is entered.

8. Volume number.–If it is available, and if a magazine is the source of the publication.

9. Issue number.–If it is available, and if a magazine is the source of the publication.

10. Source.–Where the publication came from. This generally is the name of either the contractor or the organization that did the work if the entry is a final or phase contract report, or the name of the magazine if it is an article.

11. Contractor address,–The city, State, and zip code for the contractor or, in some cases, the Government agency responsible for the work.

12. Contract number.–The Bureau contract or grant number when appropriate.

13. Bureau research center.–The Bureau research center that monitored the contract.

14 through 25.–Flags.–The word "flag" as defined for computer applications is a variable used in a computer program to indicate whether a condition has occurred. In this case, it means whether or not a mark (such as X) is entered in the field. The following flags are used in HFMSS.

Flag	*X indicates*
Contract final . . .	Contract final report.
Contract phase . .	Contract phase report.
RFP	Request for Proposal.
Bureau series . . .	Bureau publication (Information Circular, Report of Investigations, etc.).
Journal article . .	Journal or magazine article.
Manual, guide . .	Manual or guide for users.
Rules, laws	Publication detailing mining rules or laws
Seminars, training	Publication dealing with seminar, conference, or training course.
MSHA series . . .	MSHA publication.
Federal agency, not Bureau, MSHA.	Federal publication, other than those of the Bureau and MSHA.
Foreign	Foreign publication (magazine, conference proceedings, book, etc.).
Miscellaneous . . .	Publication that does not fall under any of the other types. (There are very few of these).

26. NTIS number.–The report number for a publication available from National Technical Information Service (NTIS).

27. OFR number.–If the report is on open file at the Bureau, the OFR number is given (when it is listed in the report). Open file reports are available for inspection at Bureau research center libraries.

28. Other number.–In some cases, such as for other Federal agency reports, a contract or report number is available and is entered in this field.

29. Start page.–For a journal article, a paper in conference proceedings, or a talk from a technology transfer seminar, this is the page where the article begins. For a book or report, the start page is always given as 1.

30. Length.–For a journal article, a paper in conference proceedings, or a talk from a technology transfer seminar, this is the page where the article ends. For a book or report, this is the total number of pages in the publication.

31 and 32.–Terms line 1 and terms line 2.–The descriptive terms or key words for the publication are given on these two lines. A total of 150 characters is reserved for the descriptive terms. The first term under fields 31 and 32 is always the name of one of the 19 categories discussed in a previous section.

33 through 54.–Abstract lines 1 through 22.–The abstract is broken down into purpose, procedure, and results of the work. However, no particular number of characters is reserved for each of these parts. This permits flexibility in preparing the abstract part of the entry, since the amount of space devoted to each of the three parts of the abstract can be varied, depending on what should be stressed for the particular publication. The only restriction is that the abstract as a whole cannot exceed 1,540 characters.

55. Full title.–This field combines fields 4 and 5, which permits a search based on the title of a publication to be carried out in one step. Otherwise, two steps would be needed, one instructing the computer to search field 4 and another telling it to simultaneously search field 5.

56. Full terms.–This field combines fields 31 and 32, which permits a search based on both lines of the descriptive terms for a publication in one step rather than two steps.

57. Half abstract 1.–This field combines fields 33 through 43, which permits a search for a particular word(s) or term(s) on the first 11 lines of the abstract in one step. The POISE system does not permit a search in one step on the entire abstract. However, the entire abstract can be searched at one time by entering 57 (or .ABSTRACT1) the first time the field is requested and 58 (or .ABSTRACT2) the second time.

58. Half abstract 2.–This field combines fields 44 through 54, which permits a search for a particular word(s) or term(s) on lines 12 through 22 of the Abstract.

ANNOTATED BIBLIOGRAPHY

The annotated bibliography[5] is a compendium of 634 abstracts of mining or mining-applicable documents pertaining to human factors. These were printed out as they are stored in the HFMSS computerized data base. For convenience, the original 19 categories were combined into 10 subject areas and the abstracts grouped as follows: (1) anthropometrics, work physiology, and manual materials handling, (2) equipment, (3) female miners and female workers, (4) human error and human reliability, (5) environmental factors, (6) human factors, (7) psychological factors, (8) personal protective equipment and clothing, and hand tools,, (9) job or work design, task analysis, and organizational and management practices, and (10) training.

The abstracts in this bibliography represent a majority of publications from 1969 through part of 1986 on human factors in mining and the most significant mining-applicable publications dealing with human factors for the same time period. All of these abstracts are located in and retrievable from HFMSS. Another 116 publications have been entered in HFMSS since the bibliography was assembled, and approximately 350 more are awaiting entry.

The types of documents selected to be abstracted are restricted to those relating to the 10 subject areas listed above. Each of the subject areas contains both publications dealing specifically with mining and publications that are applicable to mining and offer important information not to be found in mining reports. More specifically, if numerous mining publications are available for a particular category (such as illumination or noise), then the bulk of the material entered into HFMSS for that category deals with mining. However, if there is insufficient material having to do with mining published for a particular category (such as human error, hand tools, female miners, and task analysis), then the literature is searched for the most relevant publications from other industries (defense, nuclear, aerospace, manufacturing, etc.).

The reports in section 1 of the annotated bibliography are concerned with anthropometrics, work physiology, and manual materials handling, topics that are interrelated. Anthropometrics deals with the measurement of physical features of the body, including linear dimensions and weight and volume. The measurements obtained are used to design tools, components, equipment, and facilities to fit people in terms of such features as body dimensions, arm and leg reach, and movements. Manual materials handling has to do with the movement of mining materials through physical effort and with back injuries (causes, prevention, alleviation, etc.). Biomechanics and work physiology enter into considerations of how to handle supplies and materials most efficiently and safely.

The reports in section 2, equipment, describe a wide range of safety devices for use on mining equipment, designed from a human engineering aspect to improve the miner's safety, performance, and comfort. A variety of components and systems are discussed for application in different seam heights and for both underground and surface mines.

Section 3 reports concern the female miner, her needs that differ from those of males with respect to personal

[5] Aiken, E. G., and R. S. Fowkes. Human Factors in Mining: An Annotated Bibliography. BuMines OFR 19-89, 1987, 640 pp.

protective equipment and clothing and hand tools and in terms of the working environment. Since there have been only a limited number of studies with respect to female miners but numerous investigations and applications relative to other blue-collar female workers, a number of these abstracts have to do with female workers in industries such as manufacturing. Information contained in the reports on female workers in other industries is of interest to those involved with the problems of female miners.

Section 4 contains publications on both human error and its opposite, human reliability. Many of these deal with techniques for reducing accidents in mining as well as in other industries. Several reports deal with understanding what human error is and its causes, in an attempt to find methods to reduce its occurrence. Material having to do with human reliability delves into such subjects as the development of system reliability evaluation models, ways to integrate human and equipment reliabilities, and trends in reliability analysis. Theories and mathematical models of human error and human reliability are dealt with in some publications. The nuclear power industry and the armed services have especially investigated this subject area.

Section 5 deals with environmental factors, such as illumination, visibility, noise, and vibration, as they affect the miner's health and safety. The Bureau has long been active in this area and has published numerous reports on the results of both in-house and contract research. Some of the investigations have been for the purpose of establishing Federal guidelines and legislation for acceptable levels of illumination and noise in the mining industry.

Section 6, human factors, focuses on the human-machine-environment system. The goal of human factors is to enhance the operational efficiency and the health and safety of the miners or workers in general. Reports present methods and results of human factors research and, in the case of mining, discuss human-factors-related problems in coal and metal-nonmetal mining, surface and underground, and give recommendations for research to alleviate these problems.

Section 7, psychological factors, is concerned with a variety of factors that belong to the realm of human psychology. Examples are absenteeism, behavior modification, employee assistance programs, incentive plans, job satisfaction, motivation, stress, and employee turnover. There has been considerable attention given to some of these, such as absenteeism and incentive plans, in both mining and nonmining in attempts to improve both safety and productivity.

Section 8, personal protective equipment and clothing, and hand tools, deals with research and development studies on such mining items as headgear, outer garments, respirators, cap lamps, gloves, kneepads, boots, helmets, ear protection, eye protection, and battery packs. Little formal research on hand tools for mining has been done, except to a limited extent by the National Coal Board in the United Kingdom and by the Bureau of Mines. Thus most of the entries on hand tools come from research and applications done for industries other than mining. Topics include ergonomic principles for hand tool design, powered hand tools for use at the coal face, and analysis of hand tool injuries in underground mining.

Section 9 includes reports on job or work design, task analysis, and organizational and management practices. Job design and redesign from the human factors point of view stresses making the job fit the worker insofar as feasible, rather than trying to make the worker fit the job. Much of what is done in human factors depends on thorough task analyses of jobs. The results of these analyses can lead to the redesign of jobs, equipment modifications, or the development of improved equipment or tools. It is well known that organizational and management practices affect productivity, absenteeism, job satisfaction, and a host of other worker-related factors. Only a few reports contained in this section deal with mining, since so little work has been done in this area by the mining community, as contrasted to such other industries as aerospace, nuclear, manufacturing, and defense.

Section 10 is concerned with training as it relates to improving health, safety, and productivity in mining. Material entered deals with such topics as new-hire and refresher training, on-the-job training (OJT), task analysis applications to training, the cost effectiveness of training, utilization of learning theory and research results in developing and applying training courses and programs, and methods and results of conducting field evaluations in order to upgrade health, safety, and occupational training. Many of the publications come from mining research, but there are numerous others from fields other than mining that should be of interest to those concerned with training mine workers and supervisors.

USER'S MANUAL

The user's manual[6] explains how to search the HFMSS data base. A search of HFMSS can in general be done using a POISE program called SORT. Any of the fields discussed under the FIELDS section of this report can be searched by using either the field number or the field code. The entries retrieved can then be viewed on the screen and selected ones printed out. There are also programs that allow the user to print all of the entries in HFMSS, for example, by sequential accession number (thus showing the entries by category as discussed in the "CATEGORIES" section of this report) or in alphabetical order. In this case, other fields can also be listed for each record, such as title and author(s).

[6]Fowkes, R. S. User's Guide for the Human Factors in Mining Search System (HFMSS). BuMines OFR 21-89, 1987, 33 pp.

The user's manual consists of the following sections:

Introduction
Definitions of terms
Categories
Fields
Thesaurus of most common key words
How to search on one key word
  General method
  Displaying records retrieved
  Printing records retrieved
  Example search on one key word
How to search on two or more key words
  General method
  Example search on two key words
Discussion
Appendix.--Examples of retrieved records
  Brief format
  Entire record as stored in HFMSS

The introduction briefly discusses HFMSS and what the manual enables the user to do.

The "Definition of Terms" section is a glossary that contains 21 terms that have to do with either a POISE program, HFMSS, or computers. The terms are listed alphabetically and defined.

The "Categories" section gives the 19 categories into which HFMSS is divided and the accession number range for each category.

The "Fields" section gives the number, name, and code for each of the fields making up an HFMSS entry. Information contained in this section is needed to retrieve entries from HFMSS.

The thesaurus included with the manual consists of a list of the most important words that appear in the descriptive terms fields of HFMSS. Only those words that are found a sufficient number of times in the descriptive terms and/or abstracts and represent an area of considerable interest are listed. (A much more extensive thesaurus is discussed under the "Thesaurus" section of this report.)

The "How to Search on One Key Word" section gives a step-by-step method for retrieving entries by searching any field in the HFMSS entries, viewing those retrieved on a screen, and printing selected entries from those retrieved. Everything that will appear on the user's screen and what to type in is presented. The user is then led through an example using a descriptive term found in HFMSS.

The "How to Search on Two or More Key Words" section shows in detail how the user can search on two or more fields or two or more descriptive terms at the same time. The user is then led through an example using two descriptive terms found in HFMSS.

The user's manual appendix contains printouts of several records in the brief (accession number, title, author, descriptive terms) and full (entire record as it appears in HFMSS) formats.

The manual requires the user to type in either the field number or field code for each field that will be searched. It also requires the user to follow a long series of steps to do a search, view, and print. The steps are not complicated, and with the manual and the example, it is not difficult for a user to do the search, view, and print.

THESAURUS

As used in computer technology, a thesaurus is an index to information stored in a computer. The HFMSS thesaurus[7] was developed to help the user retrieve information from the computerized data base. It has a uniform subject arrangement and was structured to provide a basic cross-reference subject term vocabulary. Not only does the thesaurus permit the retrieval of information from any desired document or series of documents in HFMSS, it also provides a basic human factors technological vocabulary that can serve as a resource to others with similar interests in the mining industry. It is a unique report in terms of presenting a vocabulary that applies to all the areas of human factors related to mining.

Some 1,500 to 2,000 search terms, designated as key words or descriptors, were generated during the abstracting of material entered into HFMSS and are contained in the thesaurus. Figures 1 through 4 show examples of the four different arrangements used in the thesaurus to present the subject term vocabulary. Figure 1 lists all the possible choices of key words or descriptors for category 1, "Anthropometrics, Biomechanics, and Work Physiology." The thesaurus presents this information for all 19 categories. Figure 2 illustrates the letter A entries (and beginning of the B entries) in the main part of the thesaurus, which is a composite, alphabetical listing of all the key words found in the descriptive terms field of an HFMSS entry. Figure 3 is an example of a listing by accession number of all of the key words for a record in HFMSS. Accession number is defined in detail in the section of this present report called "Fields." Figure 4 shows the first part of a comprehensive index given in the thesaurus of all key words in selected subject categories, which is essentially an expansion of the listing in figure 1, using all of the corresponding abstract numbers as well.

[7]Aiken, E. G. A Thesaurus of Human Factors in Mining Terminology. BuMines OFR 20-89, 1986, 86 pp.

Category	Category subject	Key words or descriptors	Accession numbers
1	Anthropometrics biomechanics, and work physiology	Aerobic capacity Back injuries Biomechanics Biorhythms Carts Circadian rhythm Computer Controls Dynamic modeling Emergencies Energy expenditure Equipment design Ergonomics Exercise Female miners Hand tools Heart rate Human factors Isometrics Job design Jogging Lifting Low coal Lower limbs Male miners Man-machine interface Manual materials handling Miners Modeling Nutrition Performance Physical effort Physical forces Physical stress Pulling Pushing Simulation Strength Task analysis Task simulation Underground coal mine Walking Work capacity Work load	1-19

Figure 1.–Example of thesaurus key words or descriptors listed by subject category.

A

absenteeism
absorptive materials
acceleration
accident analysis
accident causes
accident modeling
accident modes
accident prediction
accident reduction
accident statistics
accidents
acclimatization
acoustic capacity
acoustic couplers
acoustic evaluation
acoustic imaging
acoustic instruments
aerobic capacity
aerospace industry
age
aircraft
aircraft accidents
air-powered tools
air traffic control systems
air stream helmet
alcoholism
alertness
analysis
analytical theory
anthropometrics
area lighting
attenuation
attitudes
audio dosimeter
audiometry
auditory defects
auger miner
automated database
automation
awards

B

back injuries
ballasts
battery
battery cord

Figure 2.–Example of thesaurus key words or descriptors in alphabetical order.

Category 1 - Anthropometrics, biomechanics, and work physiology

Accession number	Key words or descriptors
1	Anthropometrics, male miners, female miners, job design, equipment design, low coal, underground coal mining.
2	Anthropometrics, work physiology, materials handling, strength, physical effort, ergonomics, human factors.
3	Anthropometrics, lifting, work physiology.
4	Anthropometrics, strength, female workers, biomechanics, ergonomics, human factors.
5	Anthropometrics, biomechanics, work physiology, female miners, male miners, strength, work capacity, task analysis, energy expenditure, low coal mining.
6	Anthropometrics, biomechanics, lower limbs, walking.
7	Anthropometrics, hand tools, biomechanics, man-machine interface, controls, physical stress.
8	Anthropometrics, biomechanics, work physiology, nutrition, aerobic capacity, strength, female miners, male miners, job design, equipment, mining.
9	Anthropometrics, biomechanics, pushing, pulling, carts, simulation.
10	Anthropometrics, female workers, male workers, strength, isometrics, job design, back injuries, lifting.
11	Anthropometrics, biomechanics, manual materials handling, strength, job design, human factors.
12	Anthropometrics, work physiology, heart rate, exercise, stress, circadian rhythms.
13	Anthropometrics, work physiology, stress, computer, exercise, performance, oxygen uptake, heart rate.
14	Work physiology, physical working capacity, exercise, statistics, factor analysis.

Figure 3.–Example of thesaurus key words or descriptors listed in alphanumeric sequence by individual accession numbers.

Key word or descriptor	Accession numbers
Absenteeism	7006,7018,7023,7044,7045,7048, 7054,7064,7008,7049,7050,7051, 7052,7053,7068,4012
Anthropometrics	1,2,3,4,5,6,7,8,9,10,11,12,13,14, 15,16,17,18,19,4507,4510,4513, 4514,4517,1008,1076,1503,1504, 1507,1520,1521,1522,3002,3008, 3039,3062,6501,6512
Attitudes	3010,7002,7005,7018,7021,7028, 7035,7045,7047,7055,7065,7067, 7039,4017,4012,8587,8565
Back injuries	10,4504,4509,4505,4506,4510,4511, 4512,4514,4518,4519,4520,4521, 4522,4523,4524,4525,4526,4527, 4528,4530,4545,1508,1516,1525, 7066,8598,4536,4538,4539,4541, 4543,4536,17
Back pain	4536,4538,4539,4541,4543
Back stress	4536,17
Behavior	2514,2530,2532,2533,2534,2535,7006, 7028,7035,7066,7033,7034,7037, 7038,7039,7068,8550,8591,7063
Behavior modification .	7008,7034,7037,7038,7039,6004, 8521,8565
Biomechanics	4,5,6,7,8,9,10,11,17,19,4509,4501 4510,4511,4513,4514,4515,4517 4521,4524,4536,4543,1007,1042 3002,3011,3009,3014,3027,2019
Boredom	7045
Canopies	1012,1013,1016,1017,1018,1019, 1021,1027,1028,1041,1064,1066, 1004,1005,1011,1014,1015
Controls	1001,1007,1010,1036,1042,1054, 1055,1056,1057,1069,3003,3016, 3030,3039,3008,3009
Cost benefit analysis . .	7019,503,504,514,515,516,509, 510,511,512,8599,8560,8561, 8562,8567,8568,8578
Cost effectiveness	3530,3025,8560,8561,8578

Figure 4.–Example of thesaurus accession numbers associated with each key word or descriptor.

SUMMARY

The Human Factors in Mining Search System (HFMSS) was developed primarily because knowledgeable persons in the mining industry–from Government agencies, mining equipment design companies, operating coal and metal-nonmetal mines, and universities–believed that such a computerized information retrieval system would benefit researchers, trainers, equipment designers, safety engineers, and production personnel. In addition to HFMSS itself, the following were prepared relevant to HFMSS to stimulate more interest in the adoption of human factors or ergonomics principles and methods by the mining community:

1. Annotated bibliography: Consists of an overall introduction, 10 human factors category sections with printouts of over 600 entries as they appear in HFMSS, a brief introduction to each of these 10 sections, and an index.

2. User's manual: Tells the user what HFMSS and the POISE Data Management System are and gives detailed instructions on how to access and retrieve information from HFMSS. Also includes a thesaurus of the most important words found in the descriptive terms field of each entry, a glossary defining relevant computer terms and applicable POISE programs, and example printouts of HFMSS records in both a brief (accession number, title, author, and descriptive terms only) and a complete (all of the fields of the entry as it appears in HFMSS) format.

3. Thesaurus: Gives all of the descriptive terms found in HFMSS entries (at the time the annotated bibliography was compiled) in several formats so that these terms can be looked at relative to categories and accession numbers. Also lists all of the terms alphabetically and by accession number.

The HFMSS can be accessed by persons outside the Bureau by contacting Becky Farley, National Mine Health and Safety Academy, Learning Resource Center, P.O. Box 1166, Beckley, WV 25802-1166, telephone (304) 256-3226. She will provide information on accessing HFMSS and a users' guide. She will also, if requested, provide a users' guide for EMSS. The training category of HFMSS contains information on principles, methods, and research results that supplement EMSS, which references training materials only.

It is planned to update HFMSS periodically so that it does not become obsolete.

APPENDIX.–EXAMPLE PRINTOUTS–BRIEF AND FULL-ENTRY FORMATS

BRIEF FORMAT

ACCESSION NUMBER : 5
TITLE :

MINING IN LOW COAL. VOLUME I : BIOMECHANICS AND WORK PHYSIOLOGY

AUTHOR(S) :

AYOUB, M. M., N. J. BETHEA, M. BOBO, ET AL

DESCRIPTIVE TERMS :

ANTHROPOMETRICS, BIOMECHANICS, WORK PHYSIOLOGY, FEMALE MINERS, MALE MINERS, STRENGTH, WORK CAPACITY, TASK ANALYSIS, ENERGY EXPENDITURE, LOW COAL MINING

ACCESSION NUMBER : 504
TITLE :

BENEFIT-COST ANALYSIS OF HEALTH AND SAFETY RESEARCH AND DEVELOPMENT PROJECTS IN COAL, METAL AND NON-METAL MINING

AUTHOR(S) :

DAVIS, R. P., G. R. BROWN, AND W. J. DOUGLAS

DESCRIPTIVE TERMS :

ORGANIZATIONAL AND MANAGEMENT PRACTICES, COST BENEFIT ANALYSIS, RESEARCH AND DEVELOPMENT PROJECTS, HEALTH, SAFETY, MINING

ACCESSION NUMBER : 3029
TITLE :

RECOMMENDATIONS FOR HUMAN FACTORS RESEARCH AND DEVELOPMENT PROJECTS IN SURFACE MINING

AUTHOR(S) :

CONWAY, E. J. AND M. S. SANDERS

DESCRIPTIVE TERMS :

HUMAN FACTORS, ERGONOMICS, MAN-MACHINE INTERFACE, SAFETY, HAZARDS, MINING EQUIPMENT, ORGANIZATIONAL PRACTICES, SURFACE MINING

ACCESSION NUMBER : 7044
TITLE :

CAUSES OF ABSENTEEISM

AUTHOR(S) :

ATKIN, ROBERT S. AND PAUL S. GOODMAN

DESCRIPTIVE TERMS :

PHYSIOLOGICAL FACTORS, ABSENTEEISM, UNDERGROUND COAL MINING

ACCESSION NUMBER : 8516
TITLE :

TRAM VIII: TRAINING RESOURCES APPLIED TO MINING. PROCEEDINGS OF A CONFERENCE HELD AT THE PENNSYLVANIA STATE UNIV., AUGUST 23-26, 1981

AUTHOR(S) :

BENNETT, J. D.–PROCEEDINGS EDITOR

DESCRIPTIVE TERMS :

TRAINING, SAFETY, ORGANIZATIONAL PRACTICES, MANAGEMENT PRACTICES, FOREMEN, PRODUCTIVITY, MAINTENANCE, TRUCKS, SELF-RESCUERS, LONGWALL MINING, MINING

FULL-ENTRY FORMAT

ACCESSION NUMBER : 5

ENTRY DATE : 09/14/84
REVIEW DATE : 09/15/85

TITLE :

MINING IN LOW COAL. VOLUME I : BIOMECHANICS AND WORK PHYSIOLOGY

AUTHOR(S) :

AYOUB, M. M., N. J. BETHEA, M. BOBO, ET AL

MO-YR PUBLISHED : 11/81
SOURCE : TEXAS TECH UNIVERSITY
CONTRACT NO. : HO387022

VOLUME : ISSUE :
CONT. ADD. : LUBBOCK, TX 79409
BUREAU RESEARCH CENTER : PRC

CONTRACT FINAL REPORT	: X	CONTRACT PHASE REPORT	:
REQUEST FOR PROPOSALS	:	USBM SERIES	:
JOURNAL ARTICLE	:	MANUAL OR GUIDE	:
RULES, REGS, OR LAWS	:	SEMINARS OR TRAINING	:
MSHA SERIES	:	OTHER AGENCY	:
FOREIGN	:	MISCELLANEOUS	:

NTIS NO. : PB83-258160 OFR NO. : 16283 OTHER NO. :
START PAGE : 1 LENGTH : 175

DESCRIPTIVE TERMS :

ANTHROPOMETRICS, BIOMECHANICS, WORK PHYSIOLOGY, FEMALE MINERS, MALE MINERS, STRENGTH, WORK CAPACITY, TASK ANALYSIS, ENERGY EXPENDITURE, LOW COAL MINING

ABSTRACT :

PURPOSE: To evaluate the job demands associated with low-coal mining; to study the anthropometry, strength, and aerobic capacity of low coal miners to determine if they differ from the U.S. population; and to recommend, on the basis of available information, optimal job and work station design for low coal mining. PROCEDURE: Data was gathered on the physical and physiological characteristics of low coal miners during 25 visits to 17 mines in Kentucky, Pennsylvania, and West Virginia. Anthropometric measurements were made of male and female miners and used to design and build 12 mannequins representing the 5th, 50th, and 95th percentiles of the male and female population. The strength and physical work capacity of male and female low coal miners were also measured. A job analysis was performed for roof bolter, bolter helper, miner helper, and timberman, since these were the most demanding low coal mining jobs physically. RESULTS: The male and female anthropometry, except for weight and circumferential dimensions, for low coal miners was quite similar to the comparison population. Back strength for the male and female miners was significantly lower than that of the industrial worker population, which may be a contributing factor to low back problems in mining. Although shoveling, timbering, and helpers tasks were physiologically demanding, adequate rest was usually available due to frequent work stoppages. If the amount of work stoppage is decreased, rest schedules are essential.

ACCESSION NUMBER : 504

ENTRY DATE : 12/20/84
REVIEW DATE : 12/20/85

TITLE :

BENEFIT-COST ANALYSIS OF HEALTH AND SAFETY RESEARCH AND DEVELOPMENT PROJECTS IN COAL, METAL AND NON-METAL MINING

AUTHOR(S) :

DAVIS, R. P., G. R. BROWN, AND W. J. DOUGLAS

MO-YR PUBLISHED : 5/81
VOLUME : ISSUE :
SOURCE : KETRON INC.
CONT. ADD. : WAYNE, PA 19087
CONTRACT NO. : JO199042
BUREAU RESEARCH CENTER : PRC

CONTRACT FINAL REPORT : X
CONTRACT PHASE REPORT :
REQUEST FOR PROPOSALS :
USBM SERIES :
JOURNAL ARTICLE :
MANUAL OR GUIDE :
RULES, REGS, OR LAWS :
SEMINARS OR TRAINING :
MSHA SERIES :
OTHER AGENCY :
FOREIGN :
MISCELLANEOUS :

NTIS NO. : PB82-218660
OFR NO. : 7882
OTHER NO. :
START PAGE : 1
LENGTH : 106

DESCRIPTIVE TERMS :

ORGANIZATIONAL AND MANAGEMENT PRACTICES, COST BENEFIT ANALYSIS, RESEARCH AND DEVELOPMENT PROJECTS, HEALTH, SAFETY, MINING

ABSTRACT :

PURPOSE: To develop a methodology for determining the likely effects of Bureau of Mines health and safety research projects on the economic and operating parameters of those mining sections which would be affected by the research technology. PROCEDURE: Fifteen Bureau of Mines health and safety research and development projects were selected for detailed case study. Data applicable to benefit-cost analysis of the selected projects were acquired through both site visits and evaluation of project reports. A procedure and a set of criteria for measuring the benefit-cost effects of health and safety projects were developed. RESULTS: A Benefit-Cost Analysis Model, Version 1 (BCAM/1), was developed and installed on a computer. The Benefit-Cost procedure applies parametric analysis in evaluating projects. By varying parameters which have a high degree of uncertainty over a range of expected values, one obtains a corresponding set of Benefit-Cost indices. The Benefit-Cost index represents the economic output per unit of investment in the proposed technology by the mining industry sector. Data requirements for using BCAM/1 include: revenues, production, operating costs, capital costs, number, type and severity of accidents, cost of accidents, health problems encountered, and cost of health problems. The Accident Cost Indicator Model (ACIM), developed by FMC for the Bureau, is one input for BCAM/1. Pro-forma income and cash flow statements for up to 10 years of project life are outputs.

ACCESSION NUMBER : 3029

ENTRY DATE : 03/13/85
REVIEW DATE : 03/13/86

TITLE :

RECOMMENDATIONS FOR HUMAN FACTORS RESEARCH AND DEVELOPMENT PROJECTS IN SURFACE MINING

AUTHOR(S) :

CONWAY, E. J. AND M. S. SANDERS

MO-YR PUBLISHED : 5/82
SOURCE : CANYON RESEARCH, INC WESTLAKE
CONTRACT NO. : JO395080

VOLUME : ISSUE :
CONT. ADD. : CA 91361
BUREAU RESEARCH CENTER : PRC

CONTRACT FINAL REPORT	: X	CONTRACT PHASE REPORT	:
REQUEST FOR PROPOSALS	:	USBM SERIES	:
JOURNAL ARTICLE	:	MANUAL OR GUIDE	:
RULES, REGS, OR LAWS	:	SEMINARS OR TRAINING	:
MSHA SERIES	:	OTHER AGENCY	:
FOREIGN	:	MISCELLANEOUS	:

NNTIS NO. : PB84-143650 OFR NO. : 21183 OTHER NO. :
START PAGE : 1 LENGTH : 84

DESCRIPTIVE TERMS :

HUMAN FACTORS, ERGONOMICS, MAN-MACHINE INTERFACE, SAFETY, HAZARDS, MINING EQUIPMENT, ORGANIZATIONAL PRACTICES, SURFACE MINING

ABSTRACT :

PURPOSE: To identify human factors research and development needs in the surface mining industry which could be funded and directed by the Bureau of Mines, and to assign priorities to the recommended projects. PROCEDURE: Phase I consisted of: literature review, accident data analysis, preliminary interviews with MSHA and Bureau personnel, interviews with equipment manufacturers, and mine visits for familiarization of contractor personnel. Phase II encompassed on-site data collection and preliminary data analysis. Twenty-seven mines were visited during this period. Phase III dealt with defining human factors R and D projects and assigning priorities to them. After a weeding out process, final acceptance of projects and assigned priorities were determined from ratings by project team members, mine personnel, and MSHA officials. RESULTS: Seventy-four human factors research projects in surface mining were identified for possible Bureau funding. The projects were divided into the following categories: those related to–Mobile Equipment, Maintenance Shops and Areas, Plants and Mills, Organizational Factors, Safety Programs/Data, and Training. The highest priority category contained 25 projects, the middle one and 26, and the lowest 23. A table is given which briefly describes each project and lists industry, MSHA. and combined ratings. Another table presents the priority for each of the projects. A bibliography with 46 references is also included.

ACCESSION NUMBER : 7044

ENTRY DATE : 07/02/85
REVIEW DATE : 07/02/86

TITLE :

CAUSES OF ABSENTEEISM

AUTHOR(S) :

ATKIN, ROBERT S. AND PAUL S. GOODMAN

MO-YR PUBLISHED : 1/84
VOLUME : ISSUE :
SOURCE : CARNEGIE-MELLON UNIVERSITY
CONT. ADD. : PITTSBURGH, PA 15213
CONTRACT NO. : JO328033
BUREAU RESEARCH CENTER : PRC

CONTRACT FINAL REPORT : X
CONTRACT PHASE REPORT :
REQUEST FOR PROPOSALS :
USBM SERIES :
JOURNAL ARTICLE :
MANUAL OR GUIDE :
RULES, REGS, OR LAWS :
SEMINARS OR TRAINING :
MSHA SERIES :
OTHER AGENCY :
FOREIGN :
MISCELLANEOUS :

NTIS NO. :
OFR NO. :
OTHER NO. :
START PAGE : 1
LENGTH : 30

DESCRIPTIVE TERMS :

PHYSIOLOGICAL FACTORS, ABSENTEEISM, UNDERGROUND COAL MINING

ABSTRACT :

PURPOSE: To examine the causes of absenteeism for underground coal miners. PROCEDURE: Underground coal miners from 11 mines (6 in the East, 2 in the Midwest, 3 in the West) were interviewed individually at the work site and job site. Each of the 681 miners was interviewed for approximately 45 minutes. Questions covered such areas as satisfaction with various aspects of the job, absenteeism and absence control plans, labor relations, and safety. The company, the union, and the individual miner agreed to three ground rules: interviews would be voluntary, interviews would be confidential, and no reports would be issued that would identify individual miners, or small groups of miners. RESULTS: Individuals become miners because the pay and the benefits seem to be attractive. In general, miners are quite satisfied with the mines in which they work and the jobs that they have. They are generally not satisfied with rotating shifts. Most feel pressure to mine safely, but don"t feel much pressure to get the coal out, work overtime, or work idle days. Absences often seem to be planned at least a few days in advance. Most miners indicated that the major causes of absence, aside from accidents and illness, were due to the attractiveness of off-the-job activities ("being with family", "enjoying time off", "personal reasons"). About 45% of the miners suggested that management makes exceptions in the administration of the absence control plan, while only 28% claimed that the plan was too severe.

ACCESSION NUMBER : 8516

ENTRY DATE : 04/25/85
REVIEW DATE : 04/25/86

TITLE :

TRAM VIII: TRAINING RESOURCES APPLIED TO MINING. PROCEEDINGS OF A CONFERENCE HELD AT THE PENNSYLVANIA STATE UNIV., AUGUST 23-26, 1981

AUTHOR(S) :

BENNETT, J. D.–PROCEEDINGS EDITOR

MO-YR PUBLISHED : 8/81
SOURCE : PENNSYLVANIA STATE UNIV.
CONTRACT NO. :

VOLUME : ISSUE :
CONT. ADD. : U. PARK, PA 16802
BUREAU RESEARCH CENTER :

CONTRACT FINAL REPORT	:	CONTRACT PHASE REPORT	:
REQUEST FOR PROPOSALS	:	USBM SERIES	:
JOURNAL ARTICLE	:	MANUAL OR GUIDE	:
RULES, REGS, OR LAWS	:	SEMINARS OR TRAINING	: X
MSHA SERIES	:	OTHER AGENCY	:
FOREIGN	:	MISCELLANEOUS	:

NTIS NO. :
OFR NO. :
OTHER NO. :
START PAGE : 1
LENGTH : 261

DESCRIPTIVE TERMS :

TRAINING, SAFETY, ORGANIZATIONAL PRACTICES, MANAGEMENT PRACTICES, FOREMEN, PRODUCTIVITY, MAINTENANCE, TRUCKS, SELF-RESCUERS, LONGWALL MINING, MINING

ABSTRACT :

PURPOSE: To publish the proceedings of a conference on training resources applied to mining. PROCEDURE: The papers presented at TRAM VIII: Training Resources Applied to Mining, a conference held at the Pennsylvania State University during August 23-26,1981, were gathered. RESULTS: The proceedings of this conference were published and contain 30 papers. Topics covered include: organizational development to improve management/labor relations, two approaches to organization development for mine safety, management development in the coal mining industry, mine management training, productivity training at Bethlehem, training front line foremen, longwall training, the haulage truck training system, effective maintenance training, new equipment maintenance training, hydraulic cost reduction, planning of mandatory training programs, tailoring training materials for your mine, management commitment, methods of job transfer, Consol's new first aid course, self-rescurer and emergency medical training, computer-aided instruction, slide/tape presentations, TV or not TV, and capabilities and limitations of low-cost graphic media.

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Washington, D.C. 20241